

REMARKS

The Official Action rejects each of the elected claims under 35 U.S.C. § 103(a) as being unpatentable over a combination of references. As described below, independent Claims 1 and 18 have been amended in order to further highlight the patentable distinctions between the method and apparatus of the claimed invention and the cited references, taken either individually or in combination. As will be apparent, the amendment of Claims 1 and 18 merely recites a chronological relationship that was already at least implicit in the claims and therefore is not narrowing. The Official Action also objected to Claim 14 and suggested that "based setting" should be amended to read "based on setting." Claim 14 has now been amended in the manner suggested by the Official Action and the objection to Claim 14 is therefore overcome. The Official Action also rejected Claim 3 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to provide antecedent basis for "the modulation frequency of the signal that initially illuminates the host medium." Claim 3 has now also been amended to depend from Claim 2, thereby providing proper antecedent basis for the recitations of Claim 3 and overcoming the rejection of Claim 3. Moreover, Claims 33-47 that have been withdrawn from further consideration have been cancelled without prejudice to presentation in a subsequently filed divisional application. In view of the foregoing amendments and the subsequent remarks, Applicants respectfully request reconsideration of this application and allowance of the claims.

The Official Action rejects each independent claim, that is, independent Claims 1 and 18, as well as dependent Claims 2, 4, 5, 7, 10-12, 16, 17, 19, 22, 24, 25, 27, 28 and 31 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,999,836 to Robert S. Nelson, et al. in view of U.S. Patent No. 5,799,656 to Robert R. Alfano, et al. and further in view of U.S. Patent No. 5,713,532 to Matthias Essenpreis, et al. The Official Action also rejects the remainder of the dependent claims under 35 U.S.C. § 103(a) as being unpatentable over the Nelson '836 patent in view of the Alfano '656 patent, the Essenpreis '352 patent and various additional secondary references. These additional secondary references include U.S. Patent No. 4,653,855 to Curtis Birnbach, et al., U.S. Patent No. 5,983,121 to Yutaka Tsuchiya, a patent to Chance that was not specifically identified by the Official Action, U.S. Patent No. 5,590,166 to Jarmo Suni, et al., U.S. Patent No. 6,061,589 to Jack E. Bridges, et al., U.S. Patent No. 5,691,333

to Joseph M. Gabriele, et al., an article entitled "Frequency Domain Techniques Enhance Optical Mammography: Initial Clinical Results" by M. A. Franceschini, et al. and U.S. Patent No. 4,945,239 to Abund O. Wist, et al. As described below, none of the cited references, taken either individually or in combination, teach or suggest the method and apparatus of amended independent Claims 1 and 18 or, by implication, dependent Claims 2-17 and 19-32. As such, Applicants submit that the rejections under 35 U.S.C. § 103(a) are thereby overcome.

The method for detecting an abnormality in a host medium set forth by amended independent Claim 1 defines a two-stage process. In the first stage, the host medium is illuminated at a plurality of different positions, signals are detected following propagation of the signals through the host medium and any abnormality within the host medium, and a shadow image is created based upon the detected signals in which the abnormality is depicted as a suspicious region. In the second step, at least that portion of the host medium that contains the suspicious region is illuminated with frequency-swept modulated signals, the frequency-swept modulated signals are detected following propagation through at least that portion of the host medium that contains the suspicious region and the abnormality is subsequently characterized based upon the frequency-swept modulated signals that are detected. In order to highlight the two stages of the method of independent Claim 1, Claim 1 has been amended to specify that the illumination of at least that portion of the host medium that contains the suspicious region with frequency-swept modulated signals occurs "following creation of the shadow image."

Amended independent Claim 18 similarly defines an apparatus for detecting an abnormality in the host medium in which the detection occurs in essentially a two-stage process. In this regard, the apparatus of amended independent Claim 18 includes a light source for generating signals that illuminate the host medium at a plurality of different positions, a modulator for applying frequency-swept modulation to the signals generated by the light source prior to illuminating the host medium, a detector for detecting the signals following propagation through the host medium and the abnormality within the host medium and a display for presenting a shadow image based upon the detected signals in which the abnormality is depicted as a suspicious region. The apparatus of independent Claim 18 also includes a positioner for positioning the light source relative to the host medium such that the light source illuminates the

host medium at a plurality of different positions. In this regard, the positioner is recited to initially position the light source at a plurality of different positions that cover a broad portion of the host medium to facilitate generation of the shadow image. The positioner subsequently positions the light source proximate that portion of the host medium that includes the suspicious region so as to facilitate characterization of the abnormality. To highlight the two-stages in which an abnormality is detected, independent Claim 18 has been amended to recite that the positioner subsequently positions the light source proximate that portion of the host medium that includes the suspicious region "following generation of the shadow image."

As described below, none of the cited references, taken either individually or in combination, teach or suggest the two-stage process implemented by the method and apparatus of amended independent Claims 1 and 18, respectively. In this regard, the primary reference, that is, the Nelson '836 patent, describes various techniques for enhancing the resolution of breast imaging. Among other things, the Nelson '836 patent does not teach or suggest a two-stage process in which a host medium is initially illuminated and signals propagating therethrough are detected in order to create a shadow image and then in which the host medium is subsequently again illuminated, with frequency-swept modulated signals which are detected and utilized to characterize the abnormality within the host medium. Moreover, as noted by the Official Action, the Nelson '836 patent does not teach or suggest illuminating a host medium with frequency-swept modulated signals.

As such, the Official Action cites the Alfano '656 patent for its apparent disclosure of a two-stage process in which a shadow image is initially created and then further illumination of the host medium is conducted, and the Essenpreis '352 patent for its disclosure of the illumination of a host medium with frequency-swept modulated signals. With respect to the Alfano '656 patent, the Official Action alludes to the discussion in column 8, lines 52-61 of the Alfano '656 patent of fast processing/display and slow processing/display as being representative of a two-stage process in which a shadow image is initially created followed by the subsequent illumination of the host medium with frequency-swept modulated signals that are detected and subsequently utilized to characterize the abnormality as recited by amended independent Claims 1 and 18. However, the fast processing/display and the slow processing/display described by the

Alfano '656 patent does not relate to two different steps in which a host medium is initially illuminated so as to create a shadow image and then in which the host medium is subsequently illuminated with frequency-swept modulated signals so as to permit characterization of the abnormality as recited by amended independent Claims 1 and 18. Instead, the Alfano '656 patent only describes a single step of illuminating a turbid medium. In conjunction with the fast processing/display and the slow processing/display, the signals that have propagated through the turbid medium are captured by two (slow and fast) imaging systems - one of which provides a fast and rough image and the other of which provides a long signal average that provides better sensitivity and accuracy. As such, the slow and fast imaging systems receive the same signal, but merely process the signals in different manners.

In marked contrast, the method and apparatus of amended independent Claims 1 and 18 sequentially illuminate the host medium at two different instances, first to create a shadow image and subsequently with frequency-swept modulated signals in order to permit characterization of the abnormality in the host medium. Thus, the capture of the same signals by the two different imaging systems having different response times as described by the Alfano '656 patent does not teach or suggest a two-stage process as recited by amended independent Claims 1 and 18. Moreover, none of the other references, including the Nelson '836 patent, the Essenpreis '352 nor any of the additional secondary references teach or suggest a two-stage process of any type including, more particularly, the two-stage process recited by amended independent Claims 1 and 18. Instead, to the extent that the cited references describe the illumination of a host medium, the cited references only describe the illumination of the host medium on one occasion and not the repeated illumination of the host medium with the latter illumination being with frequency-swept modulated signals as recited by amended independent Claims 1 and 18.

For at least the reasons described above, the cited references, taken either individually or in combination, do not teach or suggest the method and apparatus of amended independent Claims 1 and 18. As such, Applicants submit that the rejection of amended independent Claims 1 and 18 is therefore overcome.

The dependent claims include each of the recitations of a respective independent claim. As such, the dependent claims are also patentably distinct from the cited references, taken either

individually or in combination, for at least the same reasons as described above in conjunction with the amended independent claims. However, a number of the dependent claims include additional recitations that are further patentably distinct from the cited references. In this regard, dependent Claim 3 has now been amended to depend from dependent Claim 2. As therefore recited by dependent Claim 3, the host medium is initially illuminated with signals modulated at a frequency selected from a range of frequencies, and the host medium is then subsequently illuminated with signals that are frequency-swept modulated across a larger range of frequencies than those with which the host medium was initially illuminated. The Official Action notes that the Nelson '836 patent, the Alfano '656 patent and the Essenpreis '352 patent fail to teach or suggest the recitations of dependent Claim 3. However, the Official Action states that the Birnbach '855 patent describes that the frequency sweep can be adjusted based upon thermal sensitivity and the absorption bands of interest in a sample undergoing an examination. Based upon this disclosure, the Official Action alleges that it would have been obvious to have increased the frequency band utilized during the slow processing/display of the Alfano '656 patent relative to a smaller frequency band in the fast processing/display step.

This ground of rejection fails for at least two reasons. First, the Birnbach '855 patent describes the alteration of the frequency of the signal with which a sample is irradiated and not the alteration of a frequency with which the amplitude of the signal is modulated as recited by dependent Claim 3. In this regard, the signal that illuminates the host medium in the method of dependent Claim 3 may have a constant frequency, but the amplitude of the signal is modulated at a frequency that is swept across a range with the range of frequencies over which the modulation is swept being larger during the second illumination of the host medium than during the first illumination of the host medium. As such, if the Birnbach '855 patent were combined in the manner suggested by the Official Action, the combination would require that the actual frequency of the signals that irradiate a sample be modified, as opposed to the frequency of any modulation being modified or swept across a range as recited by the claimed invention. Additionally, the description of the Alfano '656 patent and the slow processing/display and the fast processing/display is inaccurate as described above. In this regard, the Alfano '656 patent does not teach or suggest a two stage process as recited by the claimed invention in which the

host medium is separately illuminated to create a shadow image and then to further characterize the abnormality. Instead, the turbid medium is illuminated with signals that are captured in parallel by two different imaging systems having fast and slow response times. Thus, any combination of the Birnbach '855 patent and the Alfano '656 patent would not teach or suggest that the range of frequencies that are utilized for modulating the signals that illuminate a host medium would be different during a first step of illumination than during a second, subsequent step of illumination, as recited by amended dependent Claim 3.

Additionally, dependent Claims 12 and 19 recite that a light source and a detector are positioned on opposite sides of the host medium in an offset relation and that the light source and detector are subsequently moved in tandem such that the offset relation is maintained. One example of the offset relation is depicted in Figure 6 of the present application in which the detector is not in line with the light source, but is displaced to one side of the light source in an offset relation thereto. None of the cited references, taken either individually or in combination, teach or suggest positioning the light source and the detector in an offset relation to one another. The Official Action points to the Nelson '836 patent and, in particular, to Figure 2A of the Nelson '836 patent for its disclosure of a detector being in an offset relation to a light source. However, the Nelson '836 patent, in particular, Figure 2A, discloses that the detector and the light source are in an aligned, not an offset, relation.

Further, dependent Claim 23 further recites that the apparatus includes an adjustable belt extending between the plates proximate the breast and capable of being tightened such that the breast fills the region defined by the pair of plates and the adjustable belt. In conjunction with dependent Claim 23, the Official Action cites the Gabriele '333 patent. The Gabriele '333 patent discloses the compression of a breast to a plate by means of a belt that is cinched around the breast and the plate. However, the belt does not extend between a pair of plates as recited by dependent Claim 23 but, instead, about a single plate. Moreover, the belt of the Gabriele '333 patent is not capable of being tightened such that the breast fills a region defined by the pair of plates and the adjustable belt as also recited by dependent Claim 23.

As the above-described dependent claims exemplify, a number of the dependent claims also include additional recitations that are not taught or suggested by the cited references, taken

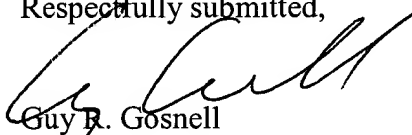
either individually or in combination. Thus, Applicants submit that the rejection of these dependent claims is overcome for these additional reasons.

CONCLUSION

In view of the amendments and the remarks presented above, it is respectfully submitted that all of the claims of the present application are in condition for immediate allowance. It is therefore respectfully requested that a Notice of Allowance be issued. The Examiner is encouraged to contact Applicants' undersigned attorney to resolve any remaining issues in order to expedite examination of the present application.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,



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